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Predictors for the Time to Viral Load Suppression among HIV Positive Adults under HAART at Public Hospitals in Amhara Region: Application of Accelerated Failure Time

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Abstract

Background: Human immune deficiency virus weakens a person's defenses against infection and leading to acquired immune deficiency syndrome. The objective of this study was to identify predictors associated with time to viral load suppression among adult HIV positive patients under HAART in public Hospitals in Amhara Region.

Method: This study was conducted at public hospitals in Amhara region, Ethiopia using a Cross sectional study design. The source of data in this study was secondary source obtained from Amhara Public Health Institution. The data were collected by the health staff working at public hospitals in the region.

Result: Among the potential predictor variables under study, Patients aged between 25-34 years (AOR=0.694, 95% CI: (0.408-0.773), p-value=0.020), Tertiary Educated patients (AOR=0.860, 95% CI: 0.762-0.906, p-value=0.001), patients disclosed their disease status AOR=0.972, 95% CI: 0.701–0.997), p-value=0.014), patients with low baseline Viral load (AOR=0.949, 95% CI: 0.815–0.989), p-value=0.018), patients with high number of CD4 cells/mm^3 (AOR=0.791, 95% CI: 0.819-0.890), p-value=0.021), good adherent patients (AOR=0.854, 95% CI;(0.746, 0.927), p-value=0.011) significantly associated with short time to viral load suppression. On the other hand, TB/HIV co-infected patients (AOR=1.317, 95% CI: 1.120, 1.436), p-value=0.015) and patients who used substance (AOR=1.241, 95% CI: (1.173, 1.383), p-value=0.026) significantly associated with longer time to viral load suppression.

Conclusion: The result in the current study revealed that significant predictor variables associated to time to viral load suppression were identified. Further studies should be done on HIV positive adult patients by considering other important independent variables not included in this study. Awareness should be created for patients to disclose their disease status and to be good adherent for their medication.

Keywords: Weibull accelerated failure time model • Time to viral load suppression • HIV/AIDS

List of Abbreviations: AFT: Accelerated Failure Time model; AIC: Akaike Information Criteria; AIDS: Acquired Immune Deficiency Syndrome; ART: Antiretroviral Therapy; BIC: Bayesian Information Criterion; BMI: Body Mass Index; CD4: Cluster Differentiation 4, G.C: Gorgerin Calendar; Hgb: Hemoglobin; HIV: Human Immune Deficiency Virus; OIs: Opportunistic Infections; PHs: Proportional Hazards; UGSCH: University of Gondar Comprehensive Specialized Hospital; VL: Viral Load; WHO: World Health Organization

Introduction

HIV infection is a public health issue. Currently, in the study area, Ethiopia has made significant strides in controlling the HIV/AIDS epidemic over the past decade. However, the prevalence remains high in both rural and urban areas where about three percent rate compared to less than one percent nationally. The other gaps to attain epidemic control include preventing the spread among priority populations by delivering support services for persons affected by HIV to ensure retention in the treatment sits. One of the mechanisms used to control the HIV epidemics is the family-focused HIV prevention, Care, and Treatment Services.

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In 2019, more than 38.0 million people were living with HIV, and more than 1.7 million people were acquired HIV. Nearly 61% of the people newly infected with HIV live in sub-Saharan Africa [1]. Ethiopia has also one of the largest HIV infected population among sub-Saharan Africa countries [2] with a total of 722,248 and 729,089 population living with HIV in the year 2016 and 2017 respectively [3]. Even though, HIV prevalence in Ethiopia decreased from 3.3% in 2000 to 0.9% in 2017 and AIDS related deaths from 83,000 deaths in 2000 to 15,600 in 2017 [4],the virus has still a significant epidemic burden [5].

Antiretroviral Therapy (ART) aims to improve the prognosis and quality of life for patients living with HIV [6] by reducing the rate of disease occurrence, progression, mortality [7], and morbidity [8]. This leads to HIV viral load suppression is the most important indicator of successful ART [9]. Initial viral load testing in people with HIV should be after 6 months of initiating ART and every one year thereafter routinely. Besides, targeted viral load testing was offered for suspected clinical or immunological failure [8]. The HIV patients should control the magnitude of viral load to have long live with the virus and this leads for suppression of viral load by the current ART regiment [10]. The World Health Organization (WHO) defines viral suppression as a viral load <1,000 copies/mL of HIV1 RNA.

One of the targets of the 90-90-90 states that, about 73% of HIV positive people under treatment had to achieve viral suppression in order to end the AIDS epidemic by 2030 [11]. In Ethiopia, there is also low viral load

suppression among HIV-positive people under treatment. Two previously conducted researches in Ethiopia declared that the percentage of suppressed HIV viral loads is 70.9% in Arba Minch and 72% in the eastern Shewa zone [12,13]. These findings indicate that the result is very far from the UNAIDS 90-90-90 target of 90% for viral load suppression [14].

Few studies have been conducted previously about predictors for time to viral load suppression [12,13,15-19]. However, such studies are restricted in a single health institution such as hospital (Small catchment areas) and not as reginal based studies including many health institutions or hospitals [1,2]. Including large catchment area, considering many health institutions may help to develop regional policy implications. Hence, the region wide study may give integrated policy implication as the country categorized by region with widest area as compared to zones. Therefore, the main objective the current study was to identify predictors associated with time to viral load suppression of among HIV positive patients under HAART in public hospitals in Amhara region North-West Ethiopia.

Materials and Methods

Study area: The study was conducted in all public hospitals in Amhara region, north-west Ethiopia. The current study was conducted using secondary data, collected by health staff, for treatment and follow up purposes. The data used in this study were extracted from the charts of patients under treatment in the selected public hospitals.

An institutional based cross section study design was conducted on adult HIV positive patients registered at different public hospitals at Amhara region, North-west Ethiopia.

Inclusion and exclusion criterion: Each patient was followed retrospectively from the start of ART treatment until suppression of viral load count, death, loss to follow-up, or the end of the study. Those patients who stopped ART for any reason during treatment, patients who did not have full recorded information regarding the viral load count and unknown patents follow up status were excluded.

Sample size determination procedures: About 18 public hospitals were considered for this study. These hospitals were selected purposively considering high number of HIV adult patients under treatment. In these hospitals, about 6000 adult HIV patients were under treatment. Among these patients, patients having measures of viral loads, having full follow ups (full records) and those with inclusion criterion were considered for data analysis. Hence, for this study about 702 study participants were selected based on the above criteria. The data were analyzed with the statistical software, SPSS software.

Data collection procedure: The important variables and their values were collected in each patient's chart and electronic database system was applied in data collection considering id number of each patient in each public hospital. The data were retrieved by trained HAART data clerks based on inclusion criteria.

Data quality: To get high standard quality data, two day training was given for data collectors based on the objective of the current study. Data collection was conducted by well-trained data extractors. To get quality data in data collection process, the principal investigator had close follow ups and checked the checklists for completeness and consistency of daily activities.

Response variable: The response variable for the current study was time to viral load suppression of HIV positive patients from the time of commencement of treatment to study period. In this study, the response variable named viral load suppression was classified as suppressed viral load (<1000 copies/ml) and unsuppressed (viral load ≥ 1000 copies/mL).

Independent variables: The predictor variables considered under this study were sex, age in years, residence, marital status, religion, level of education, disclosure status, and substance use, aCD4 count/ mm^3, baseline viral load count, hemoglobin level, weight(kg) of patients, Body Mass Index (BMI), WHO clinical stages, adherence level, Functional status, ART regiment, Tuberculosis (TB) Status, and Opportunistic Infection (OIs). Hence, these were considered as independent variables those were expected to be the determinant factors for the time to viral load suppression of HIV positive patients.

Checking assumption of Proportional Hazard (PH) model

The PH assumption of current data analysis was conducted before developing survival statistical model using GLOBAL test, considering small p-values indicate PH assumption holds rejected under the null hypothesis.

Accelerated failure time model

Accelerated Failure Time (AFT) model is an alternative modeling frameworks to the PH model for the analysis of survival time data when the PH assumptions don't satisfies [20]. AFT models measure the direct effect of the explanatory variables on the survival time instead of hazard.

In this study, AFT models were developed to model the data such as exponential, Weibull, log-logistic, and log-normal. In each case, the univariate models were fitted for the in selection of covariates statistically significant at 25% level of significance and considered in for multivariable analysis.

Model selection

To select the better model which appropriately fit to the given data, it was necessary to compare different models by using different techniques and methods. The AIC, and BIC were the most commonly used methods for model selection criteria. Therefore, the model with the smallest value of AIC and BIC was considered as the appropriate model to fit the given data.

Model diagnostics checking

The plots of Cox-Snell residuals can also be used in the graphical valuation of the adequacy of a fitted model. Thus, the plot of the estimated hazard rate of the Cox-Snell residuals should give a straight line with unit slope and zero intercept if the fitted model is good. These residual are calculated as the value of cumulative risk function evaluated at observed event time Ti.

Results

Out of the 702 participants included in this study, about 131 (18.7 %) had a baseline CD4 cell count of greater than 200 cells/mm^3. Among the participants, about 255(67.5%) had baseline viral load count less than 10,000 copies/mL, of which 230 (90.2%) had suppressed VL. On the other hand, among the 198 (52.4%) participants whose hemoglobin level greater than 11g/dl, 146 (73.7%) had suppressed VL. About 220 (58.2%) of the participants had weight less than 50 kg and about 172(45.5%) of them had Body Mass Index (BMI) greater than or equals to 25 kg/m^2. Among the patients under treatment in the study area, about 260 (68.8%), 86 (22.8%), and 70 (8.5%) were working functional status, ambulatory, and bedridden, respectively. Among the participants under study, 239 (32.9 %), had clinical stage-II, of which 501 (71.4 %) had the VL suppression. Among the good adherent patients, about 78.3% had suppressed VL. On the other hand, among the 293 HIV/TB con-infected patients, about 79.9% of them had a suppressed VL and among the 79.9% of opportunistic infectious patients, about 83% had suppressed VL (Table 1).

Among the patients under study, about 65.3% of the participants were females and of these, about 71% had suppressed VL during the follow up period. Regarding age in years of patients, a large percentage of patients 188 (49.7%) was aged between 25 and 34 years, of which only 81.4% had suppressed VL. Regarding their residence, about 33.6% of them were rural patients and 66.4% were urban patients. Similarly, among the 141 (45.2%) married participants, 106 (75.2%) had suppressed VL. Regarding religion, about 275 (72.8%) had orthodox religious follower and out of them more than a half (82.5%) suppressed VL. Regarding Level of education, more than a quarter, 132 (34.9%) were secondary educated patients of which 80.3% had suppressed VL (Table 2).

Survival status of adult HIV positive patients

Of the 702 HIV patients followed for 60 months, about 546 (77.8%) had

Table 1. Baseline clinical features of patient (n=702).

Variables	Categories	Survival Status		Total (%)
		Un suppressed (%)	Suppressed (%)	
CD4 cell	<200	158 (38,7)	110 (37.4)	268(38.2)
	≥ 200	250 (61.3)	184 (72.6)	434(61.8)
Viral load	≥ 10,000	59(19.2)	64(16.2)	123(17.5)
	<10,000	249(80.8)	330(83.8)	579(82.5)
Hgb level	<11	132 (46.5)	148(35.4)	280(39.9)
	≥ 11	152(53.5)	270(64.6)	422(60.1)
Weight	<50	64(31.2)	194(39.0)	258(36.8)
	≥ 50	141 (68.8)	303(61.0)	444(63.2)
BMI	<18.5	63(20.7)	127(32.0)	190 (27.1)
	18.5-24.9	123(40.3)	196(49.4)	319 (45.4)
	≥ 25	119(3..0)	74(18.6)	193 (27.5)
WHO clinical stage	Stage-I	25(12.0)	211(42.7)	236(33.6)
	Stage-II	38(18.3)	201(40.7)	239(34.1)
	Stage-III	112(53.4)	68(13.8)	180(25.6)
	Stage-IV	33(16.3)	14(2.8)	47(6.7)
Adherence	Poor	87(34.9)	45(9.9)	132(18.8)
	Fair	126(50.6)	224(49.5)	350 (49.9)
	Good	36(14.5)	184(40.6)	220(31.3)
Functional status	Working	118(56.7)	342(69.2)	460 (65.5)
	Ambulatory	27(13.0)	145(29.4)	172 (24.5)
	Bedridden	63(30.3)	7(1.4)	70 (10.0)
ART regiment	1d	88(24.0)	82(24.5)	170(24.2)
	1c	105(28.6)	95(28.4)	200(28.5)
	1e	119(32.4)	126(37.6)	245(34.9)
	Other	55(15.0)	32(9.5)	87(12.4)
TB Status	No	99(28.9)	334(93.0)	433(61.7)
	Yes	244(71.1)	25(7.0)	269(38.3)
OIs other than TB	No	49(47.6)	240(87.3)	489(69.7)
	Yes	54(52.4)	35(12.7)	213(30.3)

Table 2. Baseline socio-demographic characteristic of patients.

Variables	Categories	Survival Status		Total (%)
		Unsuppressed (%)	Suppressed (%)	
Sex	Female	129(46.9)	218 (51.1)	347(49.4)
	Male	146(53.1)	209 (48.9)	355(50.6)
Age category	15-24	108 (38.8)	129(30.4)	237(33.8)
	25-34	59 (21.2)	153(36.1)	212(30.2)
	35-44	100 (36.0)	80(18.9)	180(25.6)
	>44	11(3.9)	62(14.6)	73(10.4)
Residence area	Rural	189 (50.8)	117(35.5)	306(43.6)
	Urban	183(49.2)	213(64.5)	396(56.4)
Marital status	Single	69(19.0)	82(24.2)	151(21.5)
	Marriage	199(54.8)	106(31.3)	305(43.4)
	Divorced	71(19.6)	87(25.7)	158(22.5)
	Widowed	13(3.6)	31(9.1)	44(6.3)
	Separated	11(3.1)	33(9.7)	44(6.3)
Religion	Muslim	15(5.0)	122(30.6)	137(19.5)
	Orthodox	248(81.8)	227(56.9)	475(67.7)
	Other	40(13.2)	50(12.5)	90 (12.8)

Level of education	Non-Educated	85(23.7)	17(5.0)	102(14.5)
	Primary	66(18.4)	89(25.9)	155(22.1)
	Secondary	126(35.1)	106(30.9)	232(33.0)
	Tertiary	82(22.8)	131(38.2)	213(30.3)
Disclosure status	No	210(75.3)	58 (13.7)	268(38.2)
	Yes	69(24.7)	365(86.3)	434(61.8)
Substance use	No	58(13.7)	210(75.3)	268(38.2)
	Yes	365(86.3)	69(24.7)	434(61.8)

a suppressed viral load, while the remaining 156 (22.2%) were censored. The minimum follow-up period was 2.3 months, and the maximum was 50.6 months. The overall mean and median survival time was 30.6 and 24 months respectively.

Kaplan–Meier Curve for baseline Hgb level, CD4 cell count, adherence and tuberculosis

Kaplan–Meier curves for the baseline Hgb level, CD4 cell count, adherence, and tuberculosis are shown in Figure 1 below. The survival time of patients' with Hgb level less than 11g/dl and CD4 cell count less than 200 cells/mm^3 was higher than Hgb level greater than or equal to 11g/dl and CD4 cell count greater than or equal to 200 cells/mm^3. Likewise, the survival time of patients' with poor treatment adherence and TB-HIV co-infected patients was higher than the respective categories. On the other hand in Kaplan-Meier Survival curve below suggested that the above curves are at a lower risk of suppression than their counterparts (Figure 1).

Evaluation of proportion hazard assumption

The result obtained in Table 3 indicates that, the goodness of fit test gave a significant global p-value less than 5% (Table 3). Hence, the global null hypothesis stated that the proportionality assumption holds true had been rejected. As a result, the AFT model was used to analyze the survival time to VL suppression for HIV positive patients under treatment.

Accelerated Failure Time (AFT) model fitting

The covariates age in years, educational level, residence, disclosure, baseline viral load, hemoglobin level, CD4 cell count, weight, body mass index, adherence, WHO, ART regiment, TB, substance use are statistically significantly in the Univariable AFT model analysis associated with time to Viral Load (VL) suppression of HIV positive, whereas gender, religion, marital status, and functional status insignificant at a 25% level of significance. All the selected Univariable covariates were considered as potential candidate predictors in the multivariable AFT mode.

Comparison of AFT models

The model comparison criteria shown AIC and BIC values for Weibull AFT model was small. Therefore, for the HIV positive patient's data set, Weibull AFT model was the more suitable baseline distribution than others AFT model for adult HIV positive patients (Table 4).

Results of Multivariable Weibull AFT Model

The results of the multivariable Weibull AFT model (final model) fitted are presented in Table 5. In Table 5 it is indicated that age was a significant predictor for the time to VL suppression of HIV positive patients. Compared HIV positive patients under treatment whose age group with 25-34 with those patients with age group greater than 44 years, the expected survival time to VL suppression of HIV positive patients aged between 25-34 years was decreased by 30.6% (AOR=0.694, 95% CI: (0.408-0.773), p-value=0.020) given the other conditions constant. Compared non-educators with primary educators, the expected survival time to VL suppression of patients in primary education was decreased by 15% as compared to non-educated patients (AOR)=0.851, 95%CI: 0.809-0.964, p-value=0.014).

Another significant predictor in the current study was disclosure status of patients. Compared to patients disclosed their disease status to people living around them with those not disclosed the disease status, the expected survival time to VL suppression for patients disclosed their status was decreased by 2.8 % as compared to patients not disclosed the disease status, given the other conditions constant (AOR-0.972, 95% CI: 0.701–0.997), p-value=0.014).

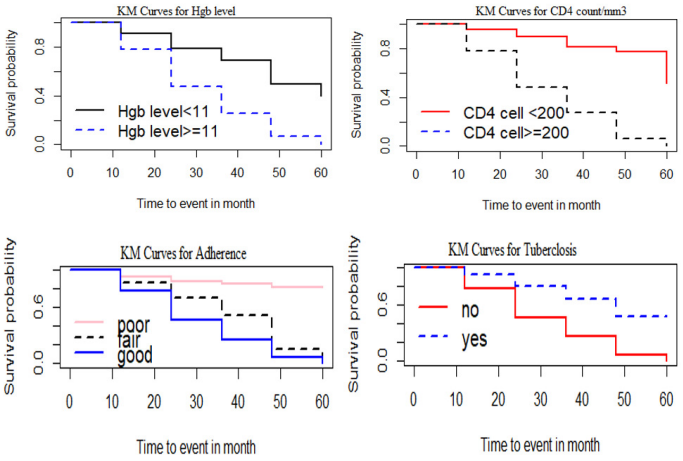

Figure 1. Kaplan-Meier survival curve for baseline Hgb level, CD4 cell, adherence and tuberculosis.

Table 3. Goodness of fit testing for PH assumption.

Covariates	Chi-square	p value
Age of participants	3.56502	0.354
Sex	0.289	0.879
Education category	3.14125	0.465
Religion of participants	0.61576	0.756
Residence area	4.34225	0.023
Marital status	6.4503	0.227
Disclosure	3.2387	0.201
Substance use	0.17964	0.218
Baseline Viral load	0.93049	0.158
Hgb level	0.22544	0.555
CD4 cell count	0.02532	0.64
Weight	0.62265	0.327
BMI	0.52342	0.622
Adherence	2.48983	0.046
WHO stages	4.27085	0.324
ART Regiment	3.51035	0.503
Functional status	1.28603	0.25
TB status	0.6276	0.242
OIs	0.35459	0.61
Global test	5.54383	0.043

Table 4. Model comparison.

Model	Exponential	Weibull	Log-logistic	Lognormal
AIC	2549.53	2456.308	3523.849	3201.178
BIC	2737.342	2615.854	4655.496	3642.844

Table 5. Results of multivariable weibull AFT model.

Variables	Categories	B	S.E	p-value	AOR	95% CI for AOR	
						Lower	Upper
Age (Ref: 15-24)	25-34	-0.3658	0.0515	0.020*	0.694	0.408	0.773
	35-44	-0.1703	0.3267	0.134	0.843	0.623	1.032
	>44	-0.0993	0.2465	0.115	0.906	0.639	1.051
Education (Ref: Non-education)	Primary	-0.1616	0.2178	0.014*	0.853	0.809	0.964
	Secondary	-0.0521	0.8681	0.026*	0.949	0.838	1.975
	Tertiary	-0.151	0.2968	0.001*	0.86	0.762	0.906
Residence (Ref: Rural)	Urban	-0.1457	0.0597	0.214	0.864	0.849	1.074
Disclosure (Ref: No)	Yes	-0.0287	0.0958	0.014*	0.972	0.701	0.997
Baseline Viral load (Ref: ≥ 10000)	<10,000	-0.0523	0.0649	0.018*	0.949	0.815	0.989
Hgb level g/dl (Ref: <11)	≥ 11	0.3257	0.0549	0.116	1.385	0.028	1.575
CD4count/mm3 (Ref: <200)	≥ 200	-0.2342	0.06	0.021*	0.791	0.819	0.89
Weight (Ref: <50)	≥50 kg	-0.0409	0.0552	0.011*	0.96	0.733	0.985
BMI (Ref: <18.5)	18.5-24.9	-0.1333	0.0644	0.019*	0.875	0.707	0.996
	≥ 25	0.1056	0.0698	0.24	1.111	0.969	1.274
Adherence (Ref: Poor)	Fair	-0.1422	0.0556	0.011*	0.868	0.766	0.967
	Good	-0.2826	0.0801	0.026*	0.854	0.746	0.927
WHO (Ref: Stage-I)	Stage-II	0.033	0.4623	0.203	1.034	0.752	1.421
	Stage-III	0.072	0.6686	0.394	1.076	0.939	1.229
	Stage-IV	0.0805	0.4129	0.127	1.084	0.899	1.946
TB (Ref: No)	Yes	0.1971	0.2647	0.015*	1.317	1.12	1.436
Ois (Ref: No)	Yes	0.0256	0.6167	0.011*	1.026	1.008	1.407
Substance use (Ref: No)	Yes	0.1322	0.3638	0.026*	1.241	1.173	1.383

Regarding baseline viral load count, those patients with baseline VL less than 1000 copies/mL had a shorter survival time to VL suppression. Hence, compared patients with baseline VL <10,000 copies/mL with those with ≥ 10,000 copies/mL, the expected survival time to VL suppression for patients with <10,000 copies/mL was decreased by 5.1 % as compared to those with baseline VL ≥ 10,000, given the other conditions constant (AOR=0.949, 95%CI: 0.815–0.989), p-value=0.018).

Patients with a CD4 count of ≥ 200 cells/mm^3 had short time to VL suppression as compared to those patients with <CD4 cell counts of 200 cells/mm^3. Hence, the expected time to VL suppression for patients with CD4 cell counts ≥ 200 cells/mm^3 was decreased by 21.9 % as compared to those patients with CD4 cell counts <200 cells/mm^3, given the other covariates constant (AOR=0.791, 95% CI: 0.819-0.890), p-value=0.001).

The time to VL suppression for fair adherent patients was significantly associated with short survival time as compared to poor adherents. The result in Table 5 revealed that the expected time to VL suppression for fair adherent patients was decreased by 13.3% as compared to poor adherent patients, given the other covariates constant(AOR=0.867, 95% CI:(0.778,0.967), p-value=0.001). Similarly, the expected time to VL supersession for good adherent patients was decreased by 25% as compared to poor adherent patients given the other conditions constant(AOR=0.868, 95% CI;(0.766, 0.967), p-value=0.011)

The expected time to VL suppression for HIV/TB con-infected patients was increased by 31.7% as compared to HIV-patients not co-infected with TB keeping the other conditions constant(AOR=1.317, 95% CI: 1.120, 1.436), p-value=0.015).

Substance use was a significant predictor for the time to VL suppression of HIV patients under treatment. Hence, the expected time to VL suppression for patients who used substance was increased by 24% as compared to those patients without substance use, given the other covariates constant (AOR=1.24,1 95% CI: (1.173, 1.383), p-value=0.038).

Overall goodness of fit test

Cox-Snell residual plot showed a model diagnosis with 95% CI for the Kaplan-Meier estimate of the Cox-Snell along the blue line. The black solid line denotes the Kaplan-Meier estimate of the survival function of the residuals (with the dashed lines corresponding the 95% pointwise confidence intervals), and the blue line, the survival function of the unit exponential distribution. This result indicated that the Weibull AFT model fitted well for adult HIV positive patient's data (Figure 2).

Discussion

The current study revealed that the median time to VL suppression was 24 months. Age of patients significantly affects the time to viral load supersession and the result obtained in the current study is supported by one the previous studies [21-23]. However, the result obtained in the other study contradicts this result [13]. The potential reason for this contradiction might be the study area and study time, sample size and difference in methodology applied. Hence, it needs further investigation.

Results of the current study revealed that the level of educational is a

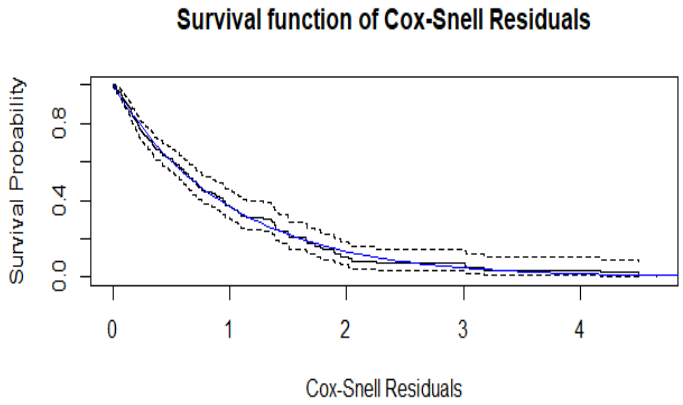

Figure 2. Cox-Snell residual plots for the Weibull AFT model of adult HIV patients.

significant predictor of time to VL suppression of HIV patients. The result in this study revealed that patients with better level of education have short time to VL suppression. The potential reason for this might be patients with better level of education have better understanding of adhering the prescribed medication and this may destruct the viral load within short time period. This result is consistent with a study conducted previously [12,16] which states that patients with better level of education have a close follow ups as compared to non-educated patients.

Disclosure status was found to be a significant predictor for time to VL suppression in HIV positive individuals in this study. The time taken to VL suppression for HIV patients disclosed the disease status is shorter than that of patients not disclosed to family member. The reason for this might be patients who disclosed the disease status have a perfection of taking pills on time without any worry of individuals living with them. Another reason for might be people living with the patients encourage (used as a reminder) to take the pills on time. This result is consistent with another result obtained previously [16]. However, the result obtained in this regard is inconsistent with another previous finding conducted in Arba Minch, Ethiopia [13], which found that patients with a disclosure HIV status may have a chance of discrimination by the other people who know the disease status. The potential reason for this difference could be due to differences in study sample size of the study population, study periods, and study.

This study illustrates that baseline viral load is a significant predictor to time to VL suppression. Patients with low baseline viral load (<10,000 copies/mL) have short period of time to recover their quality of life as compared to patients with high baseline viral load (≥ 10,000 copies/mL) which is supported by the findings from other studies [13]. These finding is not surprising due to the fact that the higher plasma viral load means the larger HIV reservoirs; therefore it takes longer time to VL suppression.

Results of the current study revealed that base line CD4 cell count significantly affect the time to VL suppression among study subjects. The time needed for VL suppression of those who have much CD4 count cells/mm^3 is shorter than those who have less number of CD4 cells/mm^3. This finding agrees with the findings of the study conducted in different settings [13,23,24]. It is expected that the higher CD4 counts usually correlated with low viral loads and therefore with shorter time to suppression.

The level of adherence has a significant effect on the time to VL suppression in such a way that good adherent patients have short time period for VL suppression as compared to poor adherent patients and this result is supported by other findings [22]. As a matter of the fact that adherence is the key, potentially modifiable, variable associated with time to viral load suppression. This is also supported by another study conducted in Uganda [24].

Substance use has a significant effect for the time to VL suppression such that substance use HIV positive individual have longer time to recover their quality of life or VL suppression in HIV positive individuals. This result is consistent with another result obtained previously [12]. Similarly, this study also showed that TB/HIV co-infection significantly affects the time to viral load suppression. TB/HIV co-infected patients are associated with longer time to VL suppression. The potential reason for this might be the existence of drug toxicity taken for TB with the pills taken for HIV needs longer time for VL suppression. This result is consistent with the previous study [25]. Another reason for this might be the fact that TB/HIV co-infected patient are more likely to be exposed to infections. As a result, it is reasonable to advocate for mandatory and frequent screening for opportunistic infections and other diseases to implement early and effective management techniques and overcome minimize viral load count.

Conclusion

In this current investigation, Weibull AFT model was better than the other AFT models. The findings of this study indicated that age of patients, level of education, disclosure status of the disease to others, the amount of baseline virial load, Baseline CD4 cell count, TB/HIV co-infection, and substance uses were significantly affected the time to Viral load suppression. It is recommended that further studies should be done on HIV positive adult patients by considering other important independent variables not included in this study. Health related education is also recommended to patients to disclose the disease status and to be good adherent. Awareness creation should be conducted for HIV patients not to be substance user.

Limitation of the Study

This study was based on retrospective cohort study design, the data obtained from adult HIV positive patients' chart. However, some important socio-demographic and clinical predictors like nutritional status, income status, homeownership, and other hematological parameters not included in the current study. Including such predictors may give additional information for the variable of interest.

Declarations

Ethics approval and consent to participate

All methods were performed in accordance with the ethical standards as laid down in the declaration of Helsinki. Hence, an informed consent was waived by Bahir Dar University research technical and ethical review board with Ref.no Stat-S/166/2022, as a retrospective nature of the data used in the current study. The study was approved by Bahir Dar University research technical and ethical review board.

Consent for Publication

Not applicable

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Data Availability

The data used in the current study cannot be shared openly to protect study participant privacy.

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Competing Interests

Author declared that there was not a conflict of interest between authors or between authors and institutions

References

1. World Health Organization. Updated recommendations on treatment of adolescents and children with chronic HCV infection and HCV simplified service delivery and HCV diagnostics. World Health Organization (2022).
2. Adal, Melaku. "Systematic review on HIV situation in Addis Ababa, Ethiopia." *BMC Public Health* 19 (2019): 1-11.
3. Ethiopian Health and Nutrition Research Institute, Federal Ministry of Health. "HIV related estimates and projections for Ethiopia-2012." (2012).
4. Kibret, Getiye Dejenu, Aster Ferede, Cheru Tesema Leshargie and Fasil Wagnew, et al. "Trends and spatial distributions of HIV prevalence in Ethiopia." *Infect Dis Poverty* 8 (2019): 1-9.
5. Girum, Tadele, Abebaw Wasie and Abdulsemed Worku. "Trend of HIV/AIDS for the last 26 years and predicting achievement of the 90–90-90 HIV prevention targets by 2020 in Ethiopia: A time series analysis." *BMC Infect Dis* 18 (2018): 1-10.
6. Brennan, Alana T., Mhairi Maskew, Ian Sanne and Matthew P. Fox. "The interplay between CD 4 cell count, viral load suppression and duration of antiretroviral therapy on mortality in a resource-limited setting." *Trop Med Int Heal* 18 (2013): 619-631.
7. Wasti, Sharada P., Edwin Van Teijlingen, Padam Simkhada and Julian Randall, et al. "Factors influencing adherence to antiretroviral treatment in Asian developing countries: A systematic review." *Trop Med Int Heal* 17 (2012): 71-81.
8. Volberding, Paul A. and Steven G. Deeks. "Antiretroviral therapy and management of HIV infection." *Lancet* 376 (2010): 49-62.
9. World Health Organization, "Monitoring response to ART and the diagnosis of treatment failure: Consolidated ARV guidelines. World Health Organization; 2016."
10. Waju, Birhanu, Lamessa Dube, Muktar Ahmed and Semira Shimeles Assefa. "Unsuppressed viral load level in public health facilities: Nonvirological predictors among adult antiretroviral therapy users in southwestern Ethiopia." *HIV/AIDS- Res Palliat Care* (2021): 513-526.
11. https://www.unaids.org/en/resources/documents/2017/90-90-90
12. Ali, Jemal Hassen and Tewodros Getinet Yirtaw. "Time to viral load suppression and its associated factors in cohort of patients taking antiretroviral treatment in East Shewa zone, Oromiya, Ethiopia, 2018." *BMC Infect Dis* 19 (2019): 1-6.
13. Hussen, Sultan, Mohammedaman Mama, Bitew Mekonnen and Mulugeta Shegaze, et al. "Predictors of time to viral load suppression of adult PLWHIV on ART in Arba Minch General Hospital: A follow up study." *Ethiop J Health Sci* 29 (2019).
14. Bain, Luchuo Engelbert, Clovis Nkoke and Jean Jacques N. Noubiap. "UNAIDS 90–90–90 targets to end the AIDS epidemic by 2020 are not realistic: Comment on "Can the UNAIDS 90–90–90 target be achieved? A systematic analysis of national HIV treatment cascades"." *BMJ Glob Heal* 2 (2017): e000227.
15. Wakooko, Paul, Yahaya Gavamukulya and Julius N. Wandabwa. "Viral load suppression and associated factors among HIV patients on antiretroviral treatment in Bulambuli district, eastern Uganda: A retrospective cohort study." *Infect Dis*13 (2020): 1178633720970632.
16. Sithole, Zvanaka, Elizabeth Mbizvo, Prosper Chonzi and More Mungati, et al. "Virological failure among adolescents on ART, Harare City, 2017-a case-control study." *BMC Infect Dise* 18 (2018): 1-8.
17. Joao, Esaú C., M. I. Gouvêa, J. A. Menezes and L. C. Sidi, et al. "Factors associated with viral load suppression in HIV-infected pregnant women in Rio de Janeiro, Brazil." *Int J STD AIDS* 23 (2012): 44-47.
18. Anglemyer andrew, George W. Rutherford, Philippa J. Easterbrook and Tara Horvath,et al. "Early initiation of antiretroviral therapy in HIV-infected adults and adolescents: A systematic review." *AIDS* 28 (2014): S105-S118.
19. Petersen, Maya L., Yue Wang, Mark J. Van Der Laan and David Guzman, et al. "Pillbox organizers are associated with improved adherence to HIV antiretroviral therapy and viral suppression: A marginal structural model analysis." *Clin Infect Dis* 45 (2007): 908-915.
20. Lelisho, Mesfin Esayas, Belete Mulatu Teshale, Seid Ali Tareke and Sali Suleman Hassen, et al. "Modeling survival time to death among TB and HIV co-infected adult patients: An institution-based retrospective cohort study." *J Racial Ethn Heal Disparities* 10 (2023): 1616-1628.
21. Chhim, Kolab, Gitau Mburu, Sovannary Tuot and Ratana Sopha, et al. "Factors associated with viral non-suppression among adolescents living with HIV in Cambodia: A cross-sectional study." *AIDS Res Ther* 15 (2018): 1-10.
22. Bulage, Lilian, Isaac Ssewanyana, Victoria Nankabirwa and Fred Nsubuga, et al. "Factors associated with virological non-suppression among HIV-positive patients on antiretroviral therapy in Uganda, August 2014–July 2015." *BMC Infect Dis* 17 (2017): 1-11.
23. Rangarajan, Suresh, Donn J. Colby, Duc Duong Bui and Huu Hung Nguyen, et al. "Factors associated with HIV viral load suppression on antiretroviral therapy in Vietnam." *J Virus Erad* 2 (2016): 94-101.
24. Diress, Gedefaw, Samuel Dagne, Birhan Alemnew and Seteamlak Adane, et al. "Viral load suppression after enhanced adherence counseling and its predictors among high viral load HIV seropositive people in north wollo zone public hospitals, northeast Ethiopia, 2019: Retrospective cohort study." *AIDS ResTreat* 2020 (2020): 8909232.
25. Silveira, Marysabel Pinto Telis, Maria de Lourdes Draschler, José Carlos de Carvalho Leite and Cezar Arthur Tavares Pinheiro, et al. "Predictors of undetectable plasma viral load in HIV-positive adults receiving antiretroviral therapy in Southern Brazil." *Braz J Infect Dis* 6 (2002): 164-171.

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